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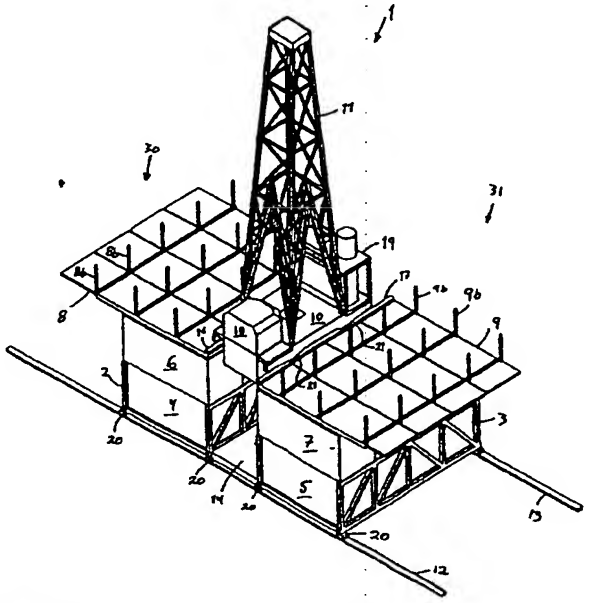
(54) Title: MODULAR LIGHT WEIGHT DRILLING RIG



(57) Abstract: A modular lightweight rig (1) comprising a plurality of modules (2, 3, 4, 5, 6, 7, 8, 9) designed to be placed on a platform deck (15) and to support a drilling deck (10) on which a derrick (11) is designed to be placed. A first set of modules (2, 4, 6, 8) is arranged in a first column (30) and a second set of modules (3, 5, 7, 9) is arranged in a second column (31). A space (32) is defined between the columns, over which space the drilling deck (10) is designed to be positioned.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Modular lightweight drilling rig.

The present invention regards a modular lightweight drilling rig in accordance with the preamble of the appended Claim 1.

Traditionally, a drilling rig is put up by a structure being assembled from basics directly on a platform, i.e. on the platform deck. This structure comprises a substructure containing service functions such as pumps, compressors and other equipment, and defines a drilling deck on top of the substructure. The actual derrick is arranged on this drilling deck. Such construction is time consuming, and must be closely co-ordinated in order to avoid delays, e.g. due to components not being ready when they are due to be assembled.

Another much used method is to build the entire structure up separately from the platform and then place it on the platform, for instance by lowering the platform so that the structure may be guided into place e.g. by a barge. This method requires the use of expensive high capacity equipment in order to guide the structure into place. It also entails great risks.

Attempts have been made to construct such a structure by use of modules, however none of the attempts so far have been particularly successful. Examples in this respect are shown in:

DE 1009575, which shows a land based drilling rig assembled by modules. However, this rig is designed to be used on land, and will not be suitable offshore.

SU 1709059, which shows a rig consisting of a large number of rectangular modules. The modules are placed two and two in each level. The modules of adjoining storeys are placed in right angle to each other, in the same way as a match tower. This means that the access to the interior of the tower is very limited.

SU 1836534, which shows a modular rig similar to SU 1709059, and with the same disadvantages.

Thus there is a great need for an improved modular rig structure in which each module has a weight that is less than the lifting capacity of a moderately sized crane. It is desirable for each module to weigh less than 25 tonnes. Furthermore there is a need for

a modular rig structure that may readily be assembled and has an overall weight that is small in comparison with conventional rig structures.

The present invention aims to provide a lightweight modular rig structure that may be assembled in a simple manner and has a high degree of applicability. It is also an object of the present invention to provide a structure consisting of a limited number of modules, in which each module has a limited weight. It is also an object of the invention that each module be easy to transport. It is a further object of the invention to provide a structure that may be assembled in a very simple and effective manner, and for which the requirement for assembly detail and supports is minimised.

An embodiment of the present invention will be explained in greater detail in the following, with reference to the accompanying drawings, in which:

Figure 1 shows an exploded view of a rig structure in accordance with the present invention;

Figure 2 shows a perspective drawing of a rig structure in accordance with the present invention;

Figure 3 shows a first side view of a rig structure in accordance with the present invention; and

Figure 4 shows a second side view of a rig structure in accordance with the present invention.

The exploded view in Figure 1 shows a modular lightweight rig structure 1 according to the present invention. The structure generally consists of the following modules: A first frame module 2 and a second frame module 3, a first lower module assembly 4 and a second lower module assembly 5, a first upper module assembly 6 and a second upper module assembly 7, a first piping deck 8 and a second piping deck 9, a drilling deck 10 and a derrick 11.

The frame modules 2 and 3 are designed to be placed on longitudinal sliding rails 12 and 13 that are fixed to the platform deck 15. A BOP deck 14 (BOP = Blow Out Preventer) is disposed between frame modules 2 and 3. The BOP 14 deck also acts as a

spacer for frame modules 2 and 3, and is connected to these in a manner so as to fix the frame modules relative to each other. The frame modules each consist of a base frame 2a, 3a respectively and two side frames 2b, 2c and 3b, 3c respectively.

The first and second lower module assembly 4 and 5 consist of a plurality of single modules 4a-4d and 5a-5d respectively, with the case as shown comprising four single modules in each module assembly.

The single modules 4a-4d and 5a-5d respectively are placed side by side, against each other. The module assembly 4 is designed to be placed inside frame module 2, while the module assembly 5 is designed to be placed inside frame module 3, on top of the base frames 2a and 3a respectively and between the side frames 2b, 2c and 3b, 3c respectively.

The first and second module assembly 6 and 7 also consist of a plurality of single modules 6a-6d and 7a-7d respectively, with the case as shown also here comprising four single modules in each module assembly. The module assemblies 6 and 7 are designed to be placed on top of the side frames 2b, 2c and 3b, 3c respectively of the frame modules 2 and 3 respectively. Thus the frame modules 2 and 3 respectively carry the entire weight of the module assemblies 6 and 7 respectively, while the module assemblies 4 and 5 carry no weight.

The first piping deck 8 is located on top of the first module assembly 6. The second piping deck 9 is located on top of the second module assembly 7. Each piping deck 8 and 9 consists of a base frame 8a and 9a and a plurality of pins 8b and 9b designed to retain a respective pipe rack.

A first transverse sliding rail 16 is provided by the edge 8c of the first piping deck 8, which edge faces the second piping deck 9. A second transverse sliding rail 17 is provided by the edge 9c of the first piping deck 9, which edge faces the first piping deck 8. The drilling deck 10 is positioned on sliding rails 16 and 17. The derrick 11 is placed on top of the drilling deck. On the drilling deck is also provided a control room 18 and a module 19 containing among other things a winch and a high-pressure manifold for controlling the downhole well pressure.

Figure 2 shows a perspective view of the modular lightweight rig in the assembled state. Here, the longitudinal sliding rails 12 and 13 provided on the platform deck 15 can be seen. The entire rig may be run slidingly along the sliding rails 12 and 13 by virtue of the frame modules 2 and 3 being designed to slide on sliding rails 12 and 13 via siding blocks 20 on the base frames 2a and 3a. As explained above, the BOP frame 14 forms a combined spacer and connector for the frame modules 2 and 3, in order for these not to be able to move relative to each other.

It is also possible to see the lower module assemblies 4 and 5 placed inside the frame modules 2 and 3, and the remaining module assemblies 6 and 7 located on top of the side frames 2b, 2c and 3b, 3c of the frame modules 2 and 3. The module assemblies 6 and 7 are designed so as to have sufficient load-bearing capacity to be able to carry the piping decks 8 and 9, including their respective pipe racks, the drilling deck 10, the control room 18 and the module 19, and the derrick 11. It is however also possible to envisage a further frame module being provided on top of each of frame modules 2 and 3 to house module assemblies 6 and 7.

The drilling rig 10 is designed to be run back and forth along the transverse sliding rails 16 and 17. For this purpose, the drilling deck is equipped with sliding blocks 21. By running the entire rig along the rails 12 and 13 and the drilling deck 10 including the derrick 11 along the sliding rails 16 and 17, the derrick may be positioned over any point within a defined relevant area.

The frame modules 2 and 3 and the piping decks 8 and 9 may if required consist of several submodules in order to reduce the size and weight of the individual elements to be transported.

As shown in the figures, the modules 2, 4, 6 and 8 are arranged in a first column 30, and the modules 3, 5, 7 and 9 are arranged in a second column 31. A space 32 is defined between the columns 30 and 31.

Figure 3 shows a side view of the rig according to the invention, along the direction of the sliding rails 12 and 13. Here, the first frame module 2 can be seen, which module contains the first lower module assembly 4. Furthermore, it is possible to see the first upper module assembly 6, which is positioned on top of the frame module 2. The module assembly 6 is shown as a trussed construction in order to indicate the fact that it

is load-bearing. The drilling deck 10 with the derrick 11, the control room 18 and the module 19 can also be seen. A hoisting winch 22 and a top-drive 23 is also shown in detail, in two positions.

The drilling deck 10 is shown in a first outer position at the extreme right-hand side of the drawing, in a solid line. A part of the drilling deck 10 is shown in a second outer position at the extreme left-hand side of the drawing, in a broken line.

Figure 4 shows the rig according to the present invention, seen in the direction across sliding rails 12 and 13. Here, the BOP frame 14, the frame modules 2 and 3 containing the lower module assemblies 4 and 5, the upper module assemblies 6 and 7, the piping decks 8 and 9, the drilling deck 10 arranged on sliding rails 16 and 17, the control room 18, and the derrick 11 may be seen.

Here, one of several skidding cylinders 24 is shown in detail, which cylinder is equipped with a gripper 25 and is designed to pull and push the rig along the sliding rails 12 and 13.

As can be seen from Figure 4, a large open space is provided between the first modules 2, 4 and 6 and the second modules 3, 5 and 7. This large open space leaves plenty of space for handling equipment such as the BOP 26 shown.

Figure 4 also shows that the derrick 11 may be modular, consisting of e.g. two modules 11a and 11b, where module 11b is to be placed on top of module 11a.

The first column 30 may for instance be designed to contain equipment that is primarily associated with process activities, while the other column may be designed to contain auxiliary and service functions. Furthermore, the first piping deck 8 may contain a rack for drill pipes, while the second piping deck 9 may contain a rack for casings.

The modules will be connected in an appropriate manner by use of assembly details. The connecting-up of modules is a technique that is well known to a person skilled in the art, and as such does not require a detailed explanation.

Claims

1.

A modular lightweight rig (1) comprising a plurality of modules (2, 3, 4, 5, 6, 7, 8, 9) designed to be placed on a platform deck (15) and to support a drilling deck (10), on which a derrick (11) is designed to be placed, characterised in that a first set of modules (2, 4, 6, 8) is arranged in a first column (30) and a second set of modules (3, 5, 7, 9) is arranged in a second column (31), between which columns (30, 31) is defined a space (32), and that the drilling deck (10) is designed to be positioned over this space (32).

2.

A modular lightweight rig according to Claim 1, characterised in that the space (32) has a width that corresponds approximately to the width of the drilling deck(10).

3.

A modular lightweight rig according to Claim 1 or 2, characterised in that a BOP deck (14) is provided in the space (32), immediately above the deck (15) of the platform, and that the BOP deck (14) defines the width of the space and is connected to each of the columns (30, 31).

4.

A modular lightweight rig according to one of Claims 1, 2 or 3, characterised in that a first sliding rail (16) is provided by the upper edge of the first column (30), which edge faces the second column (31), that a second sliding rail (17) is provided by the upper edge of the second column (31), which edge faces the first column (30), and that the drilling deck is arranged for sliding motion on top of the sliding rails (16, 17).

5.

A modular lightweight rig according to one of Claims 1, 2, 3 or 4, characterised in that the first column (30) comprises a frame module (2) in which a lower module assembly (4) is designed to be placed, and that the second column (31) comprises a frame module (3) in which a lower module assembly (5) is designed to be placed.

6.

A modular lightweight rig according to Claim 5,

c h a r a c t e r i s e d i n that a first upper module assembly (6) is designed to be placed on top of the first frame module (2) and be carried by this, and that a second upper module assembly (7) is designed to be placed on top of the second frame module (3) and be carried by this.

7.

A modular lightweight rig according to Claim 6,

c h a r a c t e r i s e d i n that a first piping deck (8) is designed to be placed on top of the first upper module assembly (6), that a first sliding rail (16) is provided by that edge of the first piping deck (8) which faces the second column (31), that a second piping deck (9) is designed to be placed on top of the second module assembly (7), that a second sliding rail (17) is provided by that edge of the second piping deck (9) which faces the first column (30), and that the drilling deck (10) is designed to be run back and forth on the sliding rails (16, 17).

8.

A modular lightweight rig according to any of the preceding claims,

c h a r a c t e r i s e d i n that each of the columns (30, 31) is arranged on the third and fourth sliding rails (12, 13), which are placed on the deck (15) of the platform, that the third and fourth sliding rails (12, 13) generally extend across the first and second sliding rails (16, 17), and that the columns are designed to be run back and forth on the sliding rails (12, 13) together.

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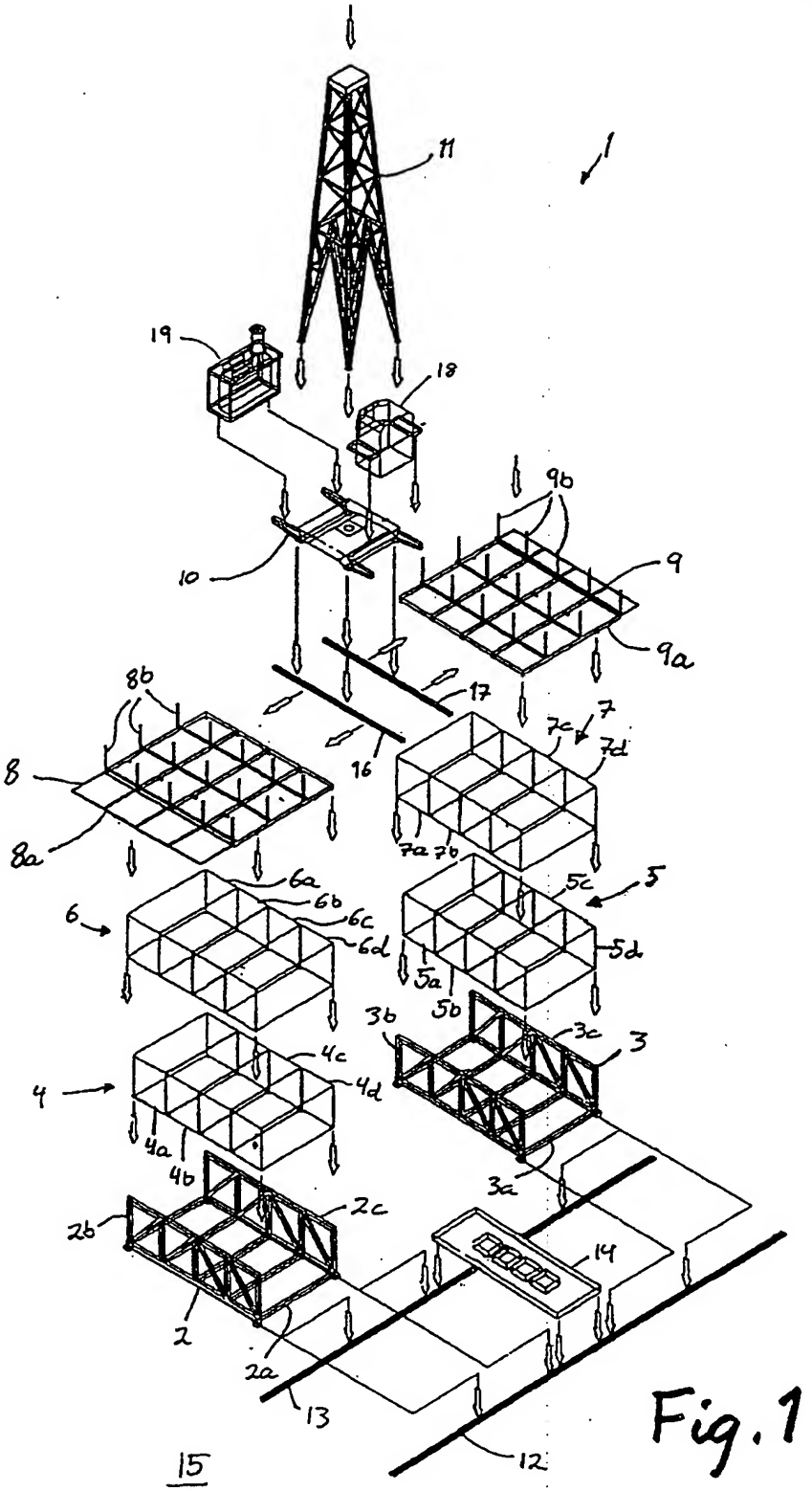
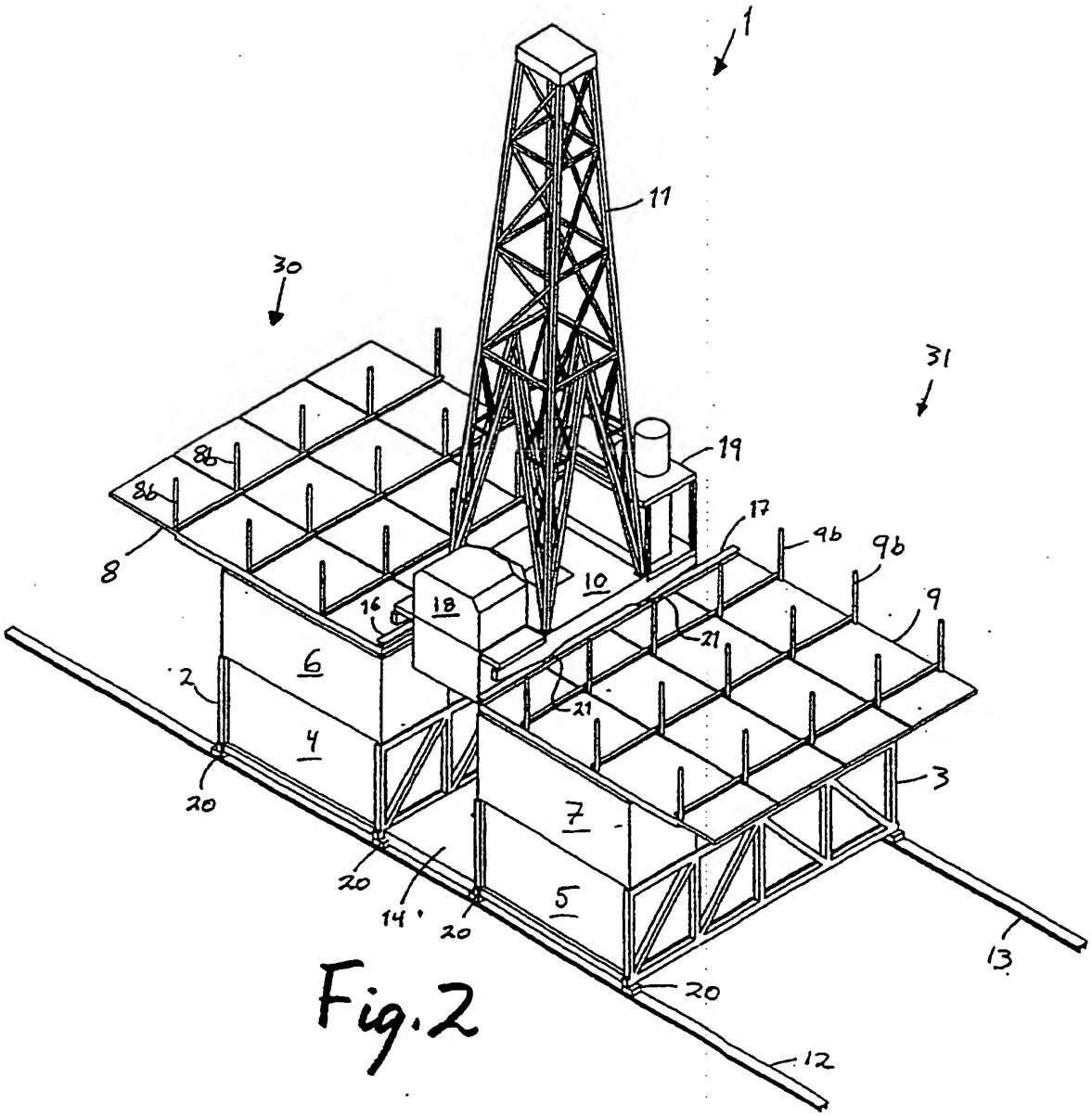


Fig. 1


1
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30
31
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9b
9b
9
8b
8b
8
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Fig. 2

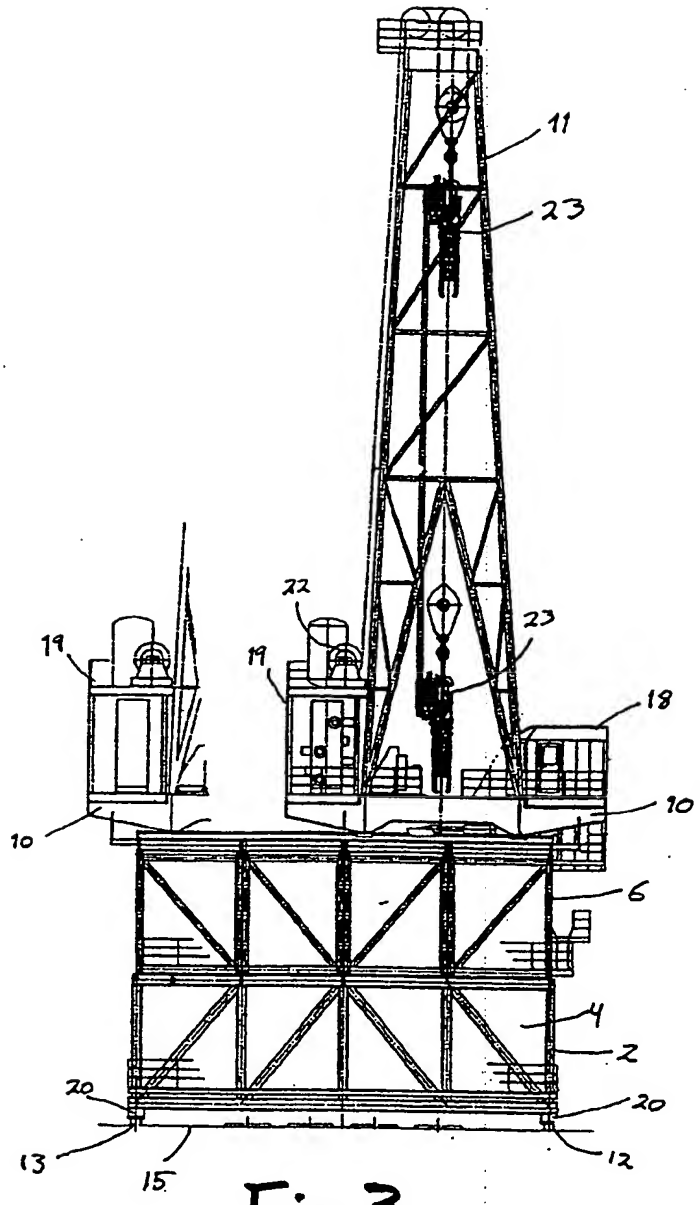

Fig. 3

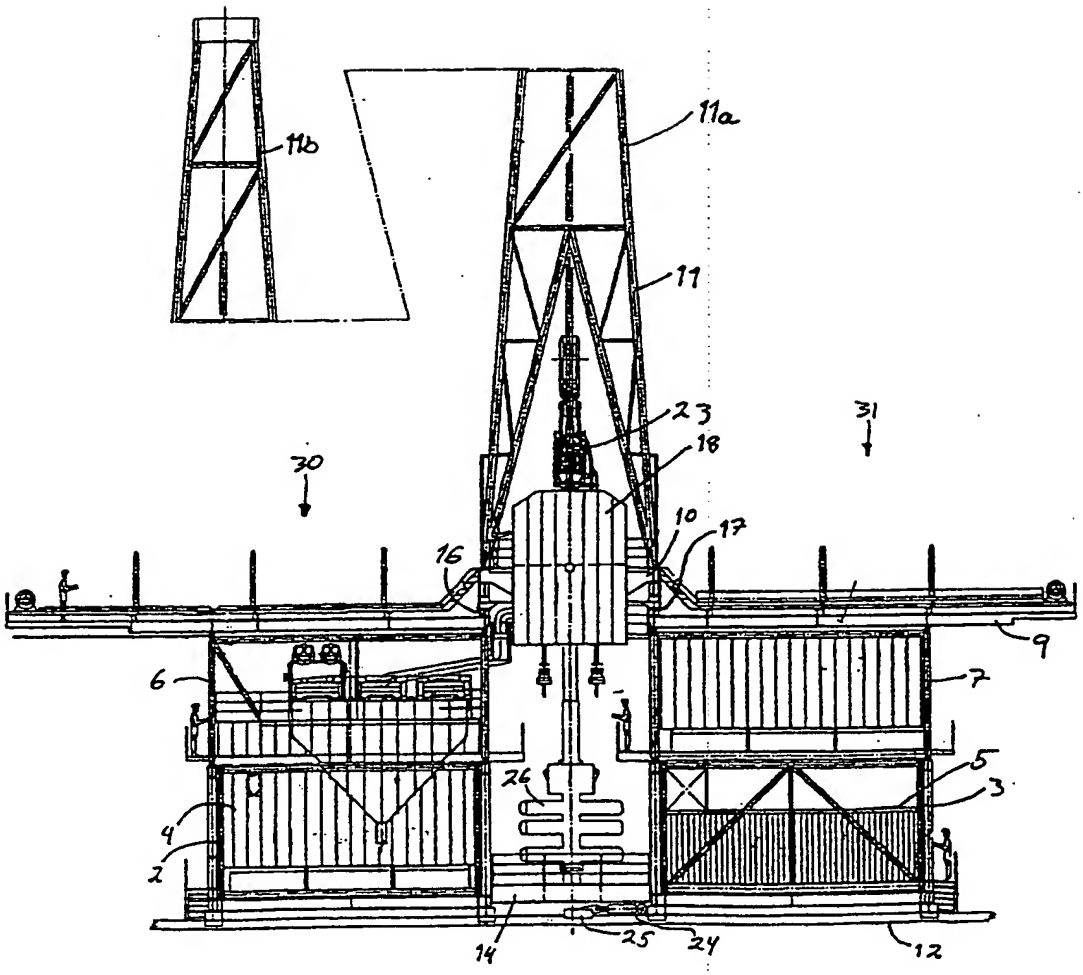

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 01/00002

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: E21B 15/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: E21B, B63B, E02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4899832 A (R.C. BIERSCHEID, JR.), 13 February 1990 (13.02.90) --	1-8
A	US 5356239 A (D.W. CANTON), 18 October 1994 (18.10.94) --	1-8
A	US 4161376 A (J.E. ARMSTRON), 17 July 1979 (17.07.79) --	1-8

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 April 2001	17-04-2001
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Christer Bäcknert / MRo Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

Information on patent family members

25/02/01

International application No.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4899832 A	13/02/90	NONE	
US 5356239 A	18/10/94	NONE	
US 4161376 A	17/07/79	BR 7703222 A	08/02/78
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